FIG.1: Flow chart illustrating the valuation method

```
┌─────────────────────────────┐
│      Valuation method       │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│      Structuring method     │
│            100              │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│   Data management system    │
│            200              │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│        Expert system        │
│            300              │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│     Integration system      │
│            400              │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│    Store and report results │
│            500              │
└─────────────────────────────┘
              ┊
              ▼
┌─────────────────────────────┐
│     Optimization system     │
│            600              │
└─────────────────────────────┘
```
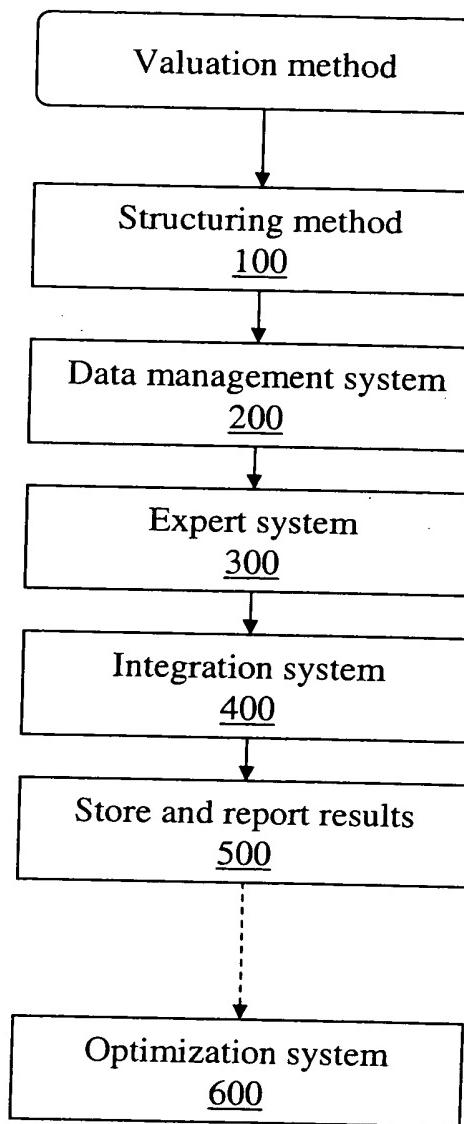
FIG.2: Flow chart illustrating the structuring method

100

Identify and define
financial interests
110

Identify and define
operational units
120

Identify and define
operational subunits
130

Define fundamental units
140
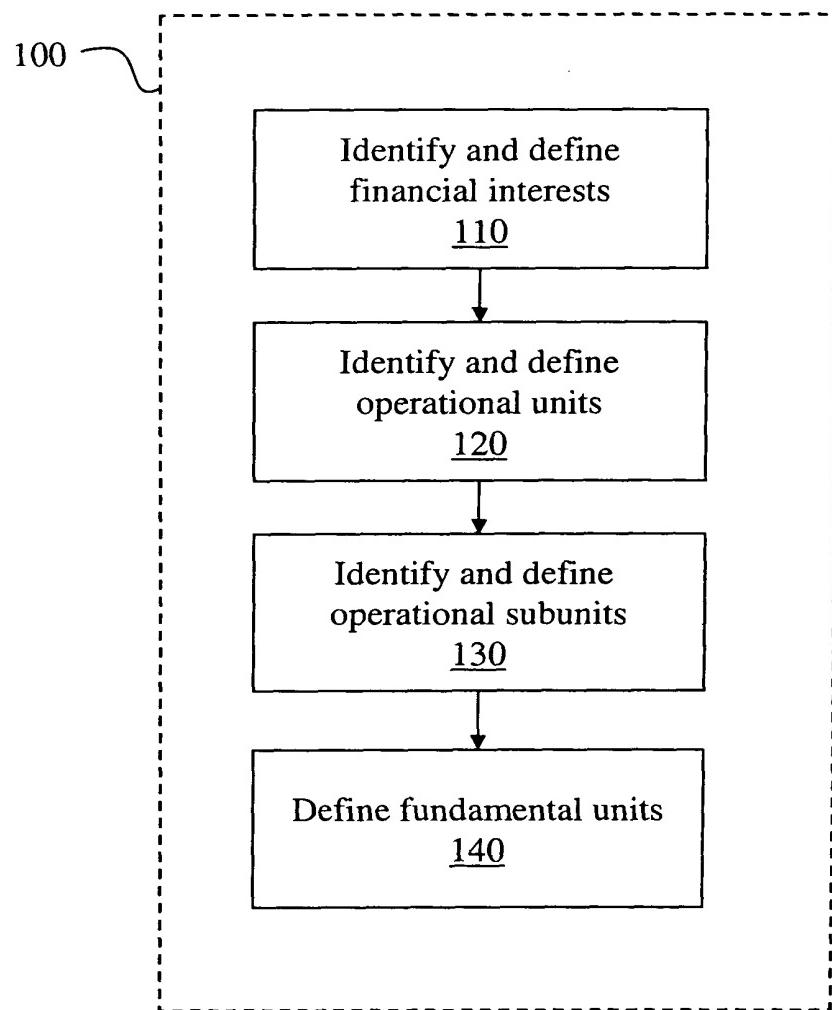
FIG.3: Standard structuring scheme

Subsidiary companies

Financial interests

Company

Assets

Processes

Interfaces

Fundamental Units

Business Units

Operational Unit
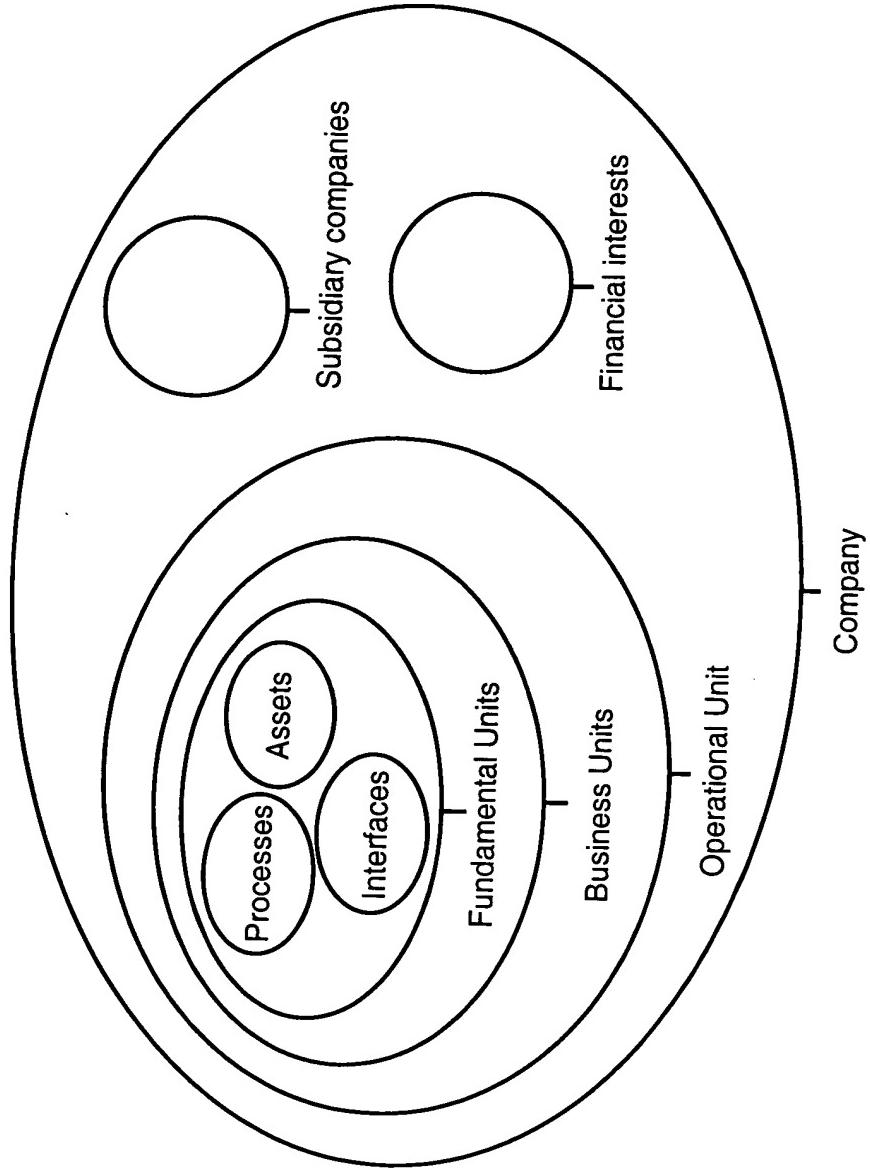
FIG.4: Structuring example

```
                    ┌──────────────────────────┐
                    │         Company          │
                    └──────────────────────────┘
              ┌────────────────┴────────────────┐
      ┌──────────────────┐          ┌──────────────────────────┐
      │    Financial     │          │  Operational units/      │
      │    interests     │          │  subunits                │
      └──────────────────┘          └──────────────────────────┘
```

```
                    ┌──────────────────────────┐
                    │ Operational units/subunits│
                    └──────────────────────────┘
         ┌───────────────────┼───────────────────┐
```

Hierarchy Level 1	Subsidiary 1 (S_1)	Subsidiary 2 (structure analog S_1) ...	Subsidiary n (structure analog S_1)

Hierarchy Level 2	Businessunit 1 (BU_1) of S_1	Businessunit 2 (BU_2) of S_1 ...	Businessunit m (BU_m) of S_1

Hierarchy Level 3	Product/functional units of BU_1 of S_1	Product/functional units of BU_2 of S_1 ...	Product/functional units of BU_m of S_1

FIG.5: Flow chart illustrating the data management system

200

```
Load external data
(e.g. market data, benchmark
data, public company data)
210
```

```
Optimize collection process
(e.g. load specialized module)          ◄─── A
220
```

```
Request and collect internal
data at current hierarchy level         ◄─── B
230
```

```
Analyze data, determine
parameters, pre-valuation
240
```

```
Are data complete,        No
consistent and coherent ?
250
```

Yes

```
Store data and report results
260
```
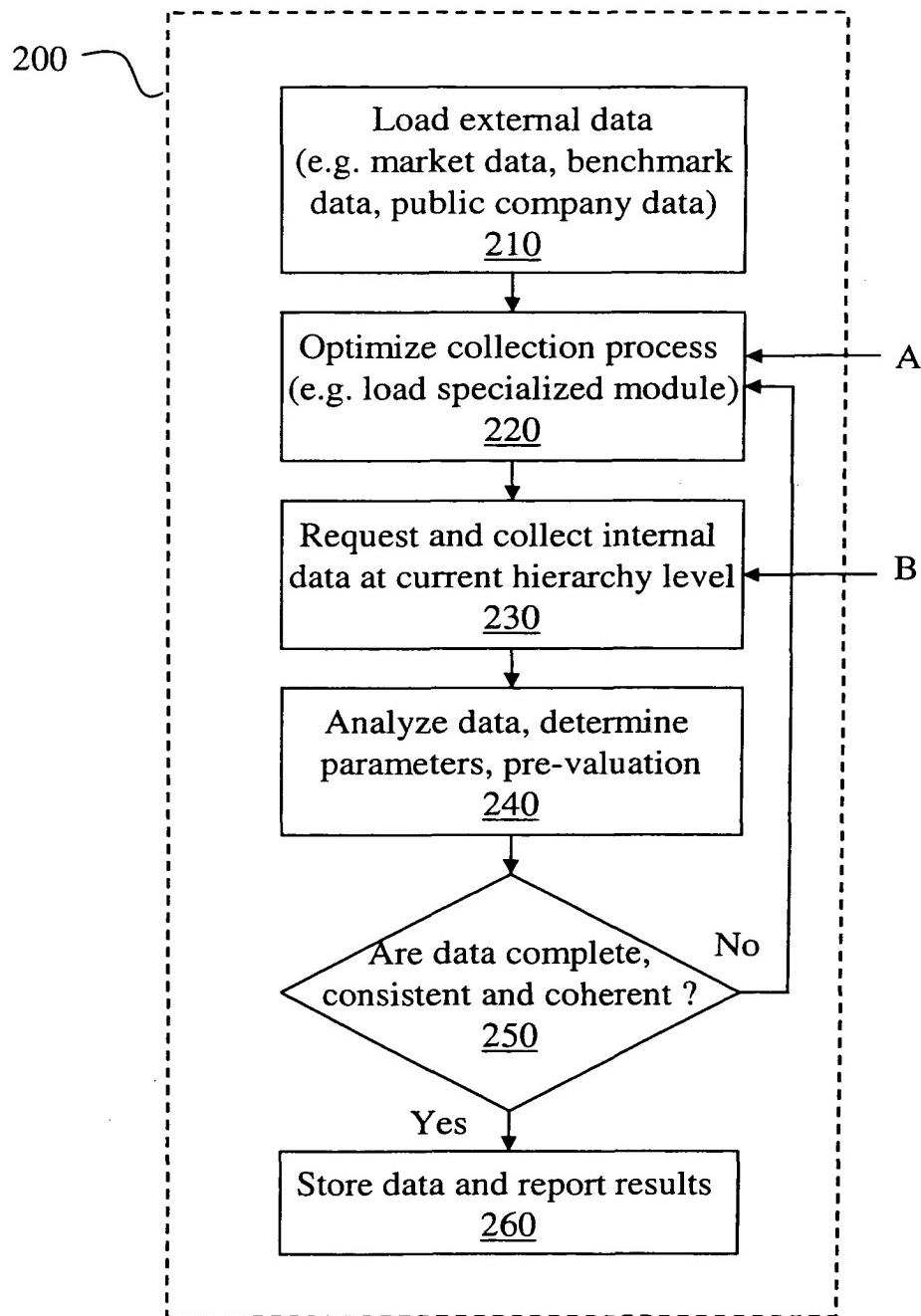
FIG.6: Illustration of uncertainties associated with historical fluctuations and future expectations
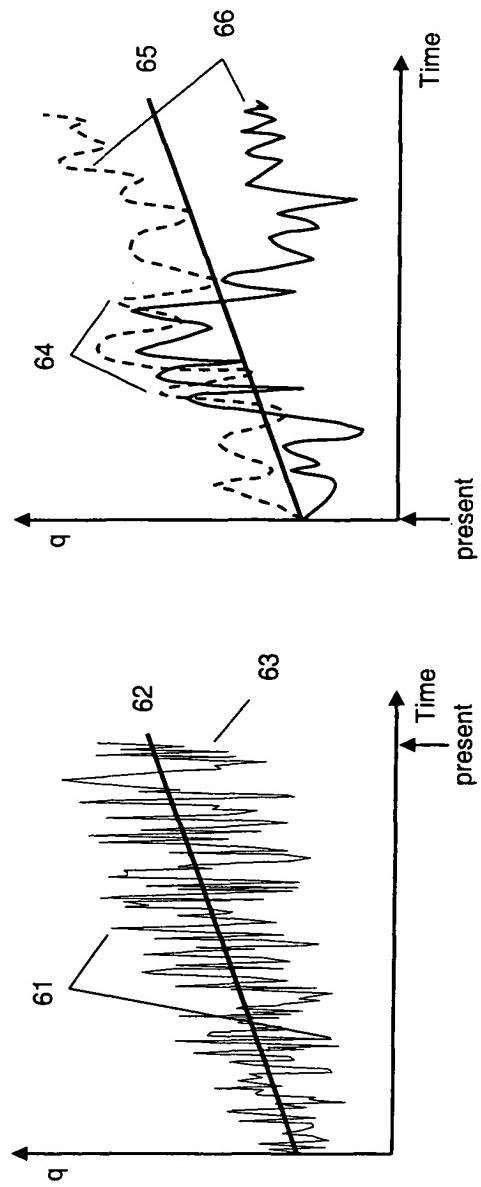
FIG.7: Illustration of a 2-dimensional normal distribution

Factor 1

Factor 2

Probability

0

0

71

72

73

74

75
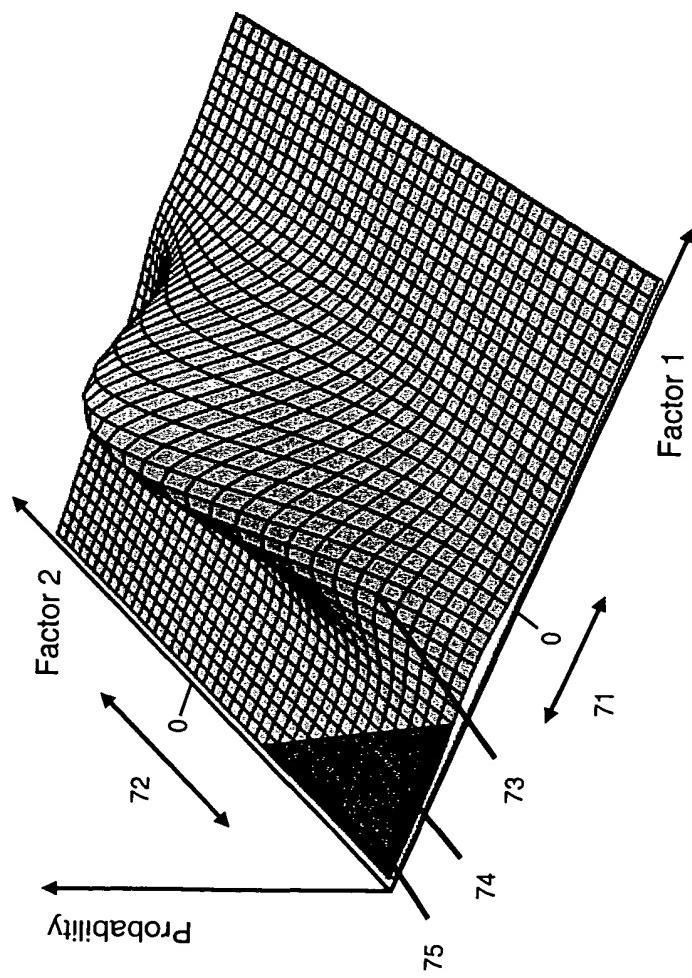
FIG.8: Flow chart illustrating the expert system

300

Load pre-defined
benchmark figures
310

Compare with benchmarks
and classify current type
320

Identify corresponding
strengths, weaknesses,
and peculiarities,
330

Identify corresponding
risks and opportunities
340

Are additional
data necessary for
quantification ?
350

Yes → B

No

Store and report results
360
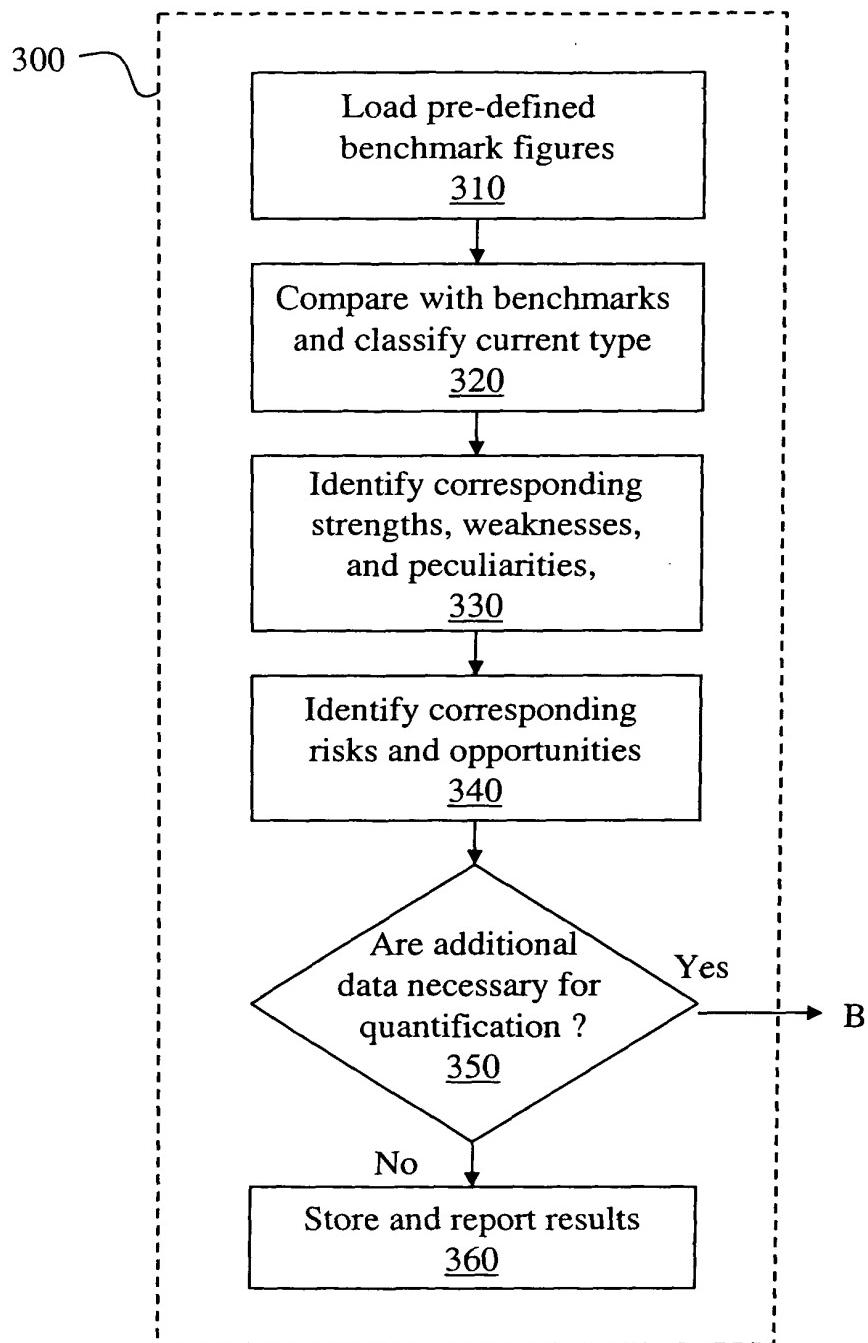
FIG.9: Flow chart illustrating the integration system

400

Receive set of figures
with uncertainty parameters
410

Determine multivariate
probability distribution
420

Integrate to obtain
probability distributions for
consolidated quantities
430

Do all results
have required precision ?
440

No → A

Yes

Store and report results
450
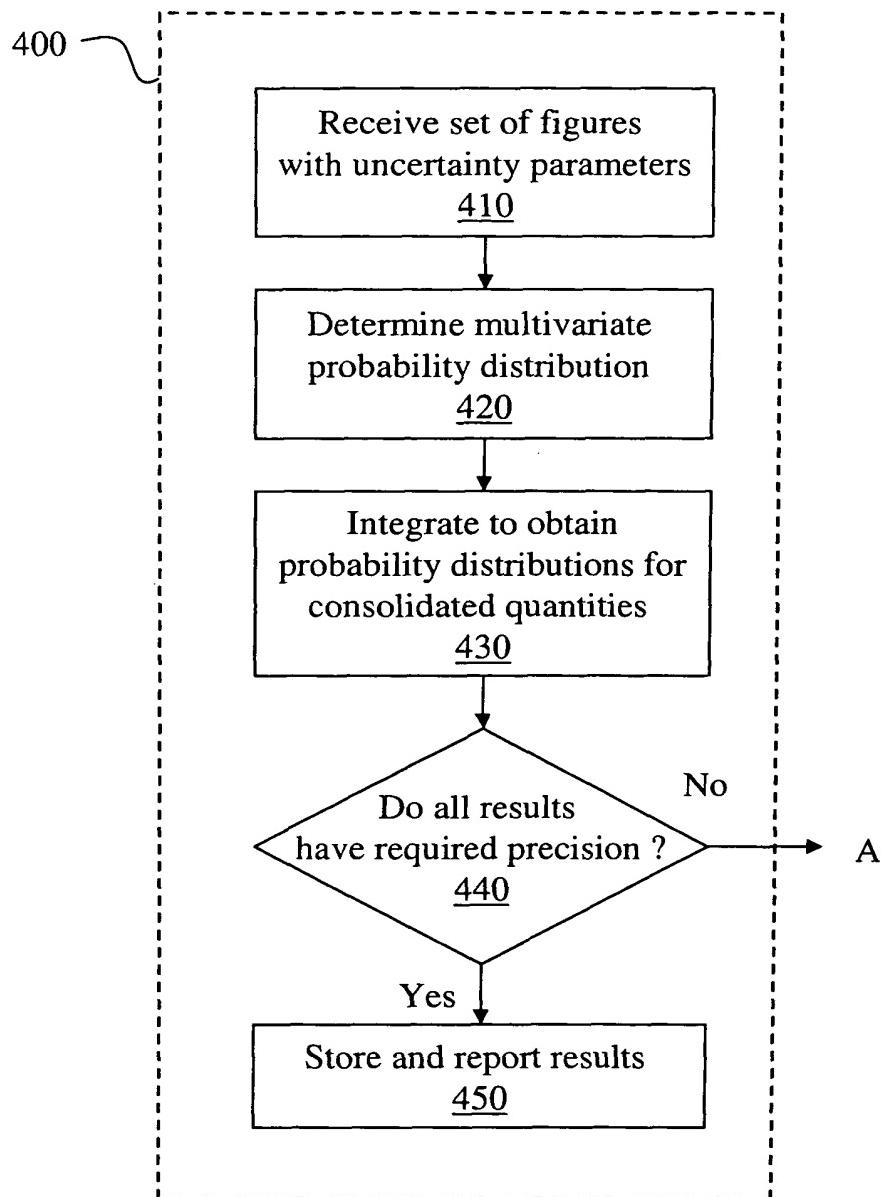
FIG.10: Illustration of the aggregation of uncertainties with correlations

Average: $x = (x_1 + x_2)/2$

Volatility: $\sigma = 0.5\sqrt{\sigma_1^2 + \sigma_2^2 + 2\rho\sigma_1\sigma_2} \leq (\sigma_1 + \sigma_2)/2$

Example:

	Conventional addition (perfect correlation)		Independent estimates (no correlation)	Total-cancellation (anti-correlation)
$\rho = \cos(\theta)$	1	0.5	0	-0.5	-1
θ	0°	60°	90°	120°	180°
estimate 1	10±2	10±2	10±2	10±2	10±2
estimate 2	10±2	10±2	10±2	10±2	10±2
average	10±2	10±1.73	10±1.41	10±1	10±0

101 102 103 104 105 106

107 108 109
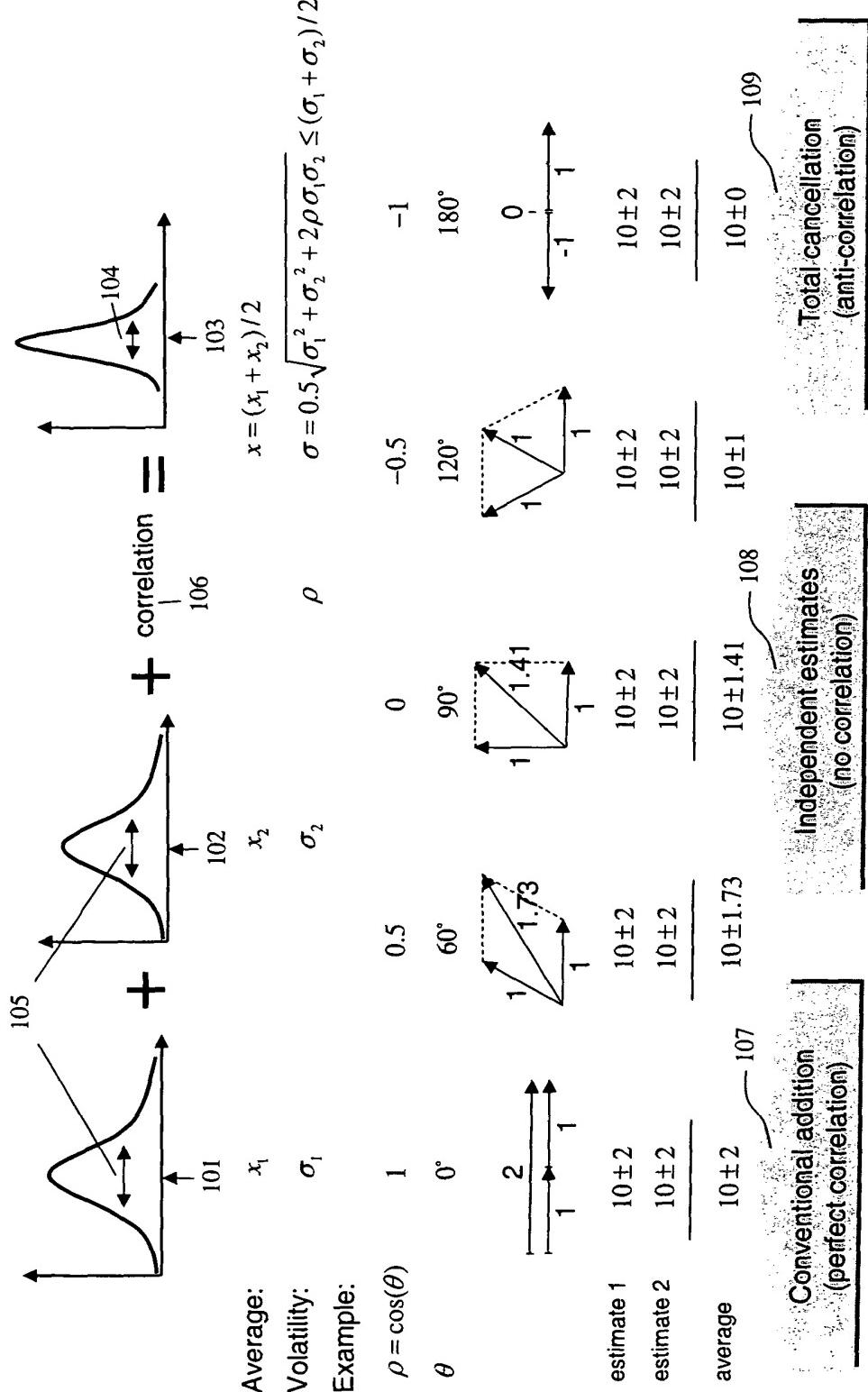
FIG.11: Example for an aggregation hierarchy

Aggregated: r

$$\overbrace{}$$

r_1	r_2	r_3
r_4	$\cdots$	r_N

Hierarchy Level 1

r_{11}	r_{12}	r_{13}
r_{14}	$\cdots$	r_{1k_1}

r_{21}	r_{22}	r_{23}
r_{24}	$\cdots$	r_{2k_2}

$\cdots$

r_{N1}	r_{N2}	r_{N3}
r_{N4}	$\cdots$	r_{Nk_N}

Aggregated: r_1 Aggregated: r_2 Aggregated: r_N

Hierarchy Level 2

r_{111}	r_{112}	r_{113}
r_{114}	$\cdots$	$r_{11m_{11}}$

r_{121}	r_{122}	r_{123}
r_{124}	$\cdots$	$r_{12m_{12}}$

$\cdots$

r_{1k_11}	r_{1k_12}	r_{1k_13}
r_{1k_14}	$\cdots$	$r_{1k_1m_{1k_1}}$

Aggregated: r_{11} Aggregated: r_{12} Aggregated: r_{1k_1}
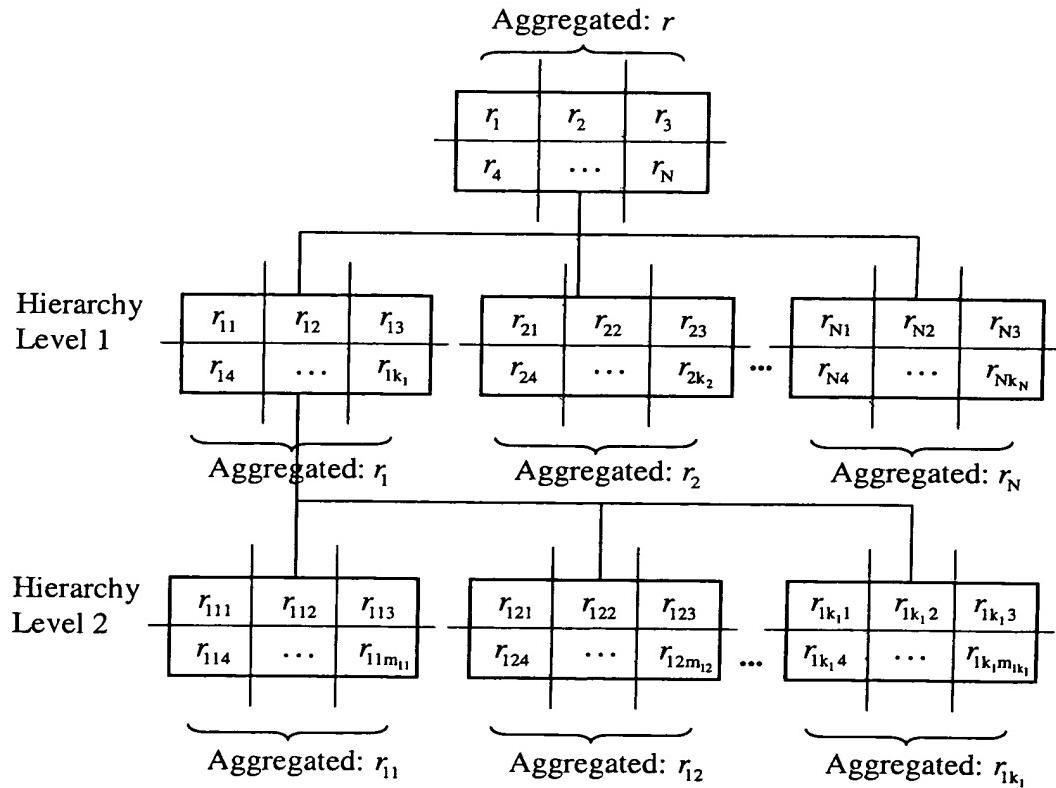
FIG.12: Illustration of a rating based on the Merton-Model (prior art)

Asset Value

121

122

123

124

125

126

127

128

129

0

T

Time
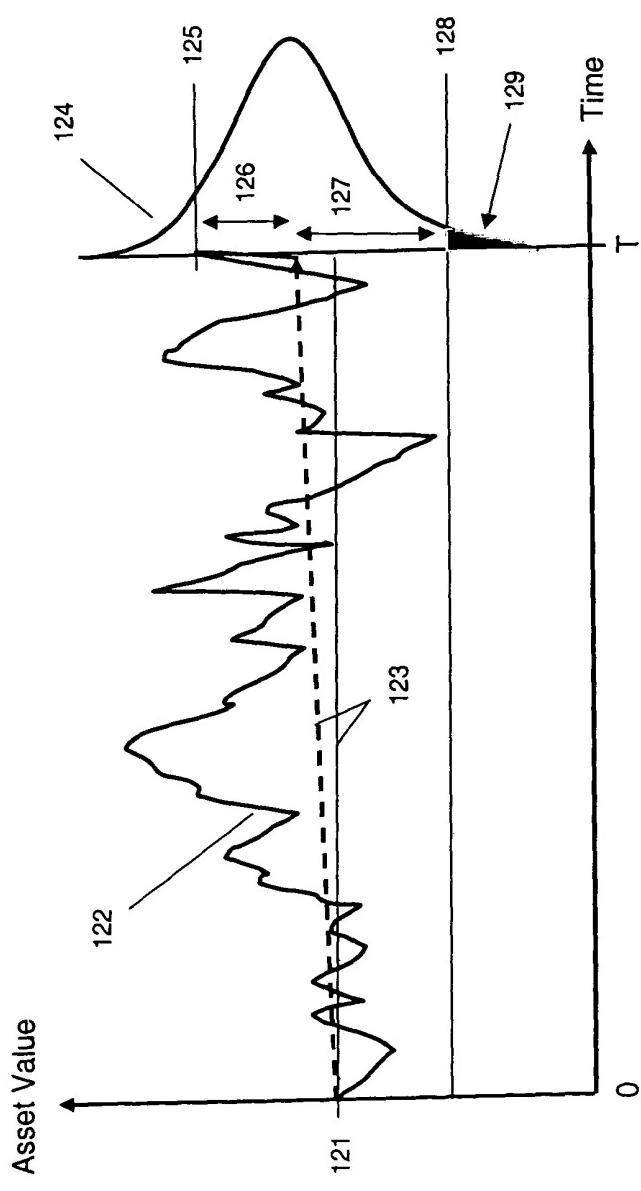
FIG.13: Illustration of a multidimensional valuation scheme with correlations

A. 1-dimensional case
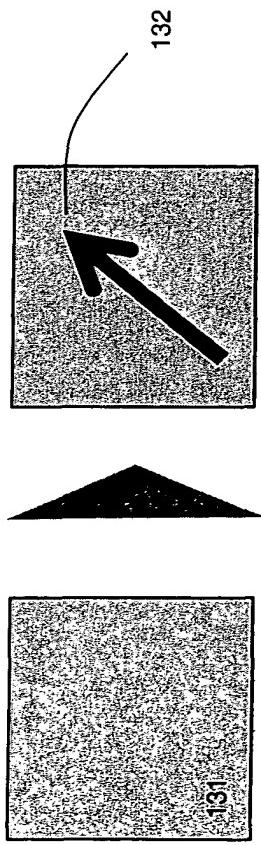

B. Multidimensional case
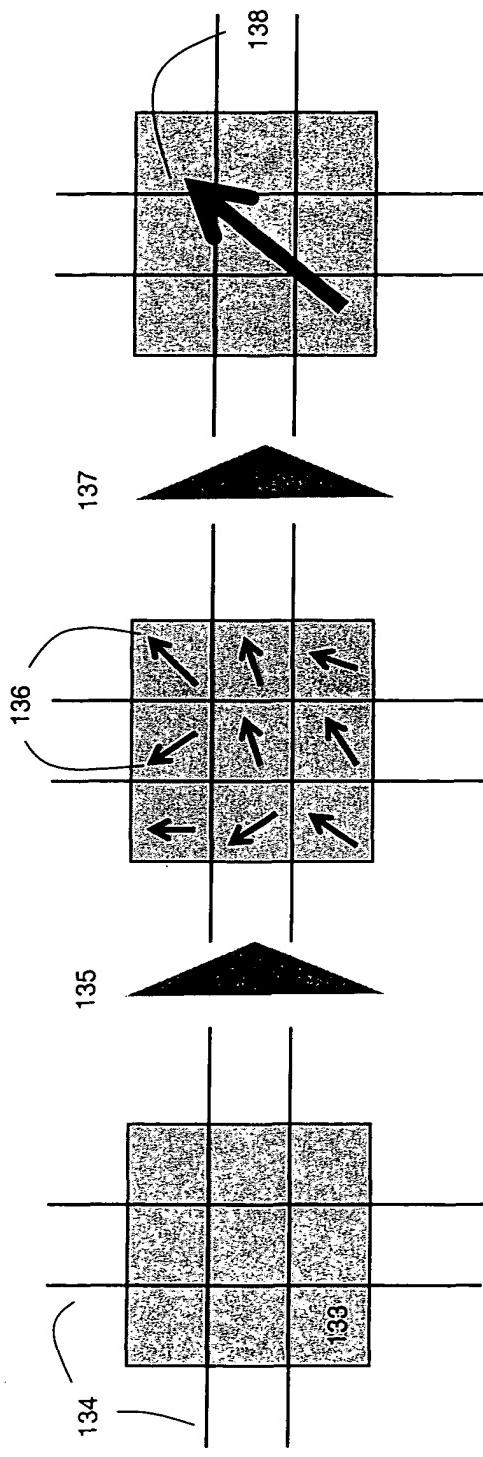
FIG.14: Illustration of a rating including correlations
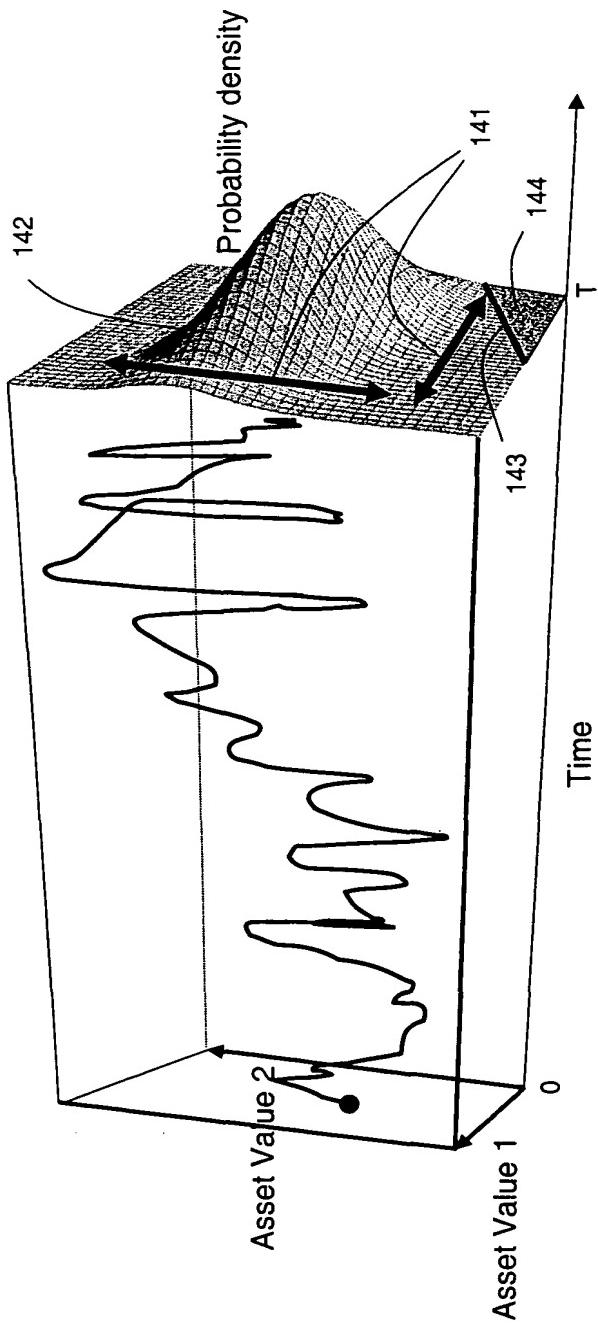
FIG.15: Illustration of a risk-return portfolio
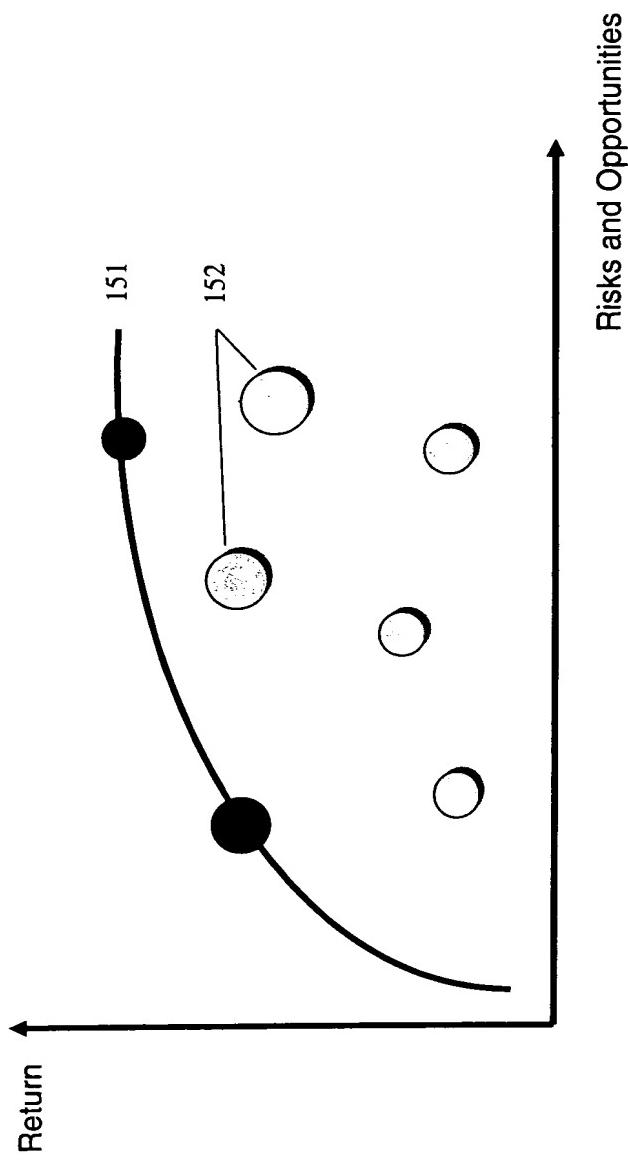
FIG.16: Flow chart illustrating the optimization system

500

Load data
510

Define objectives
and constraints
520

Optimize
530

Are results consistent
and optimal?
540

No

Yes

Store and report results
550
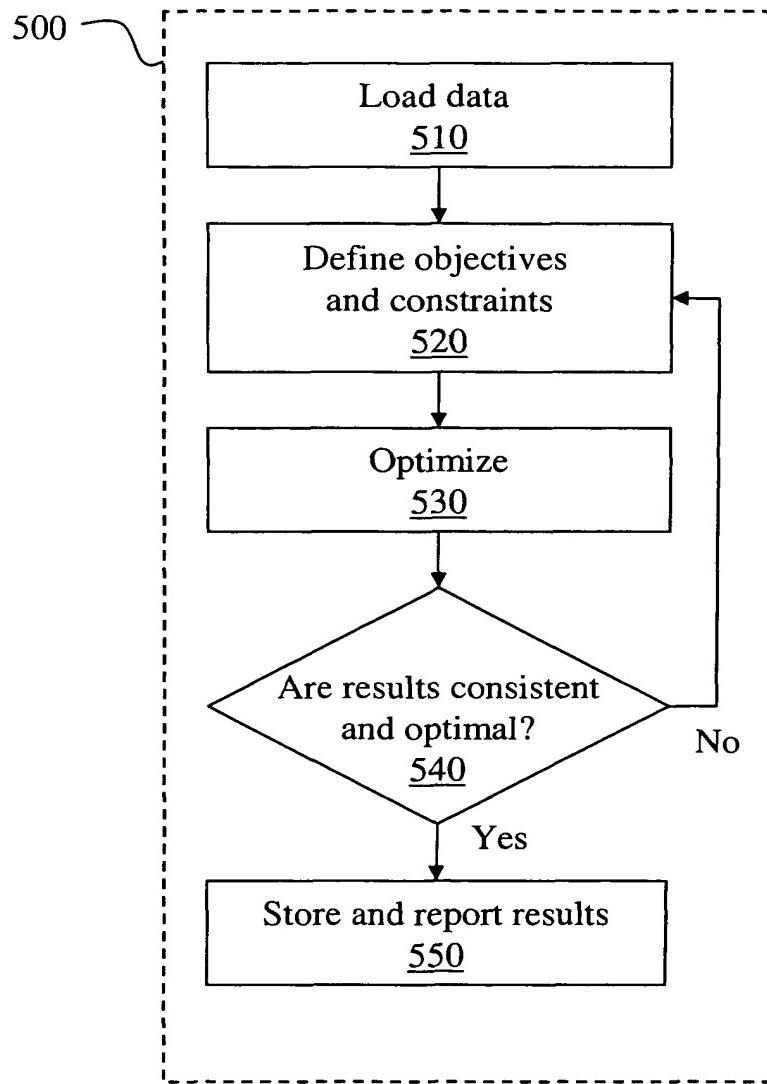
FIG.17: Example for the structuring of a company

Company A
(company to be valued)

Operational units

Financial units

Operational and financial units

Foreign subsidiaries (FSD)

Home subsidiaries (HSD)

Financial interests (FI)

FSD1 – North America
FSD2 – South America

HSD1 – Europe

FI1 – 10% company B
FI2 – 25% company C

Operational subunits

Business Units (BU)

BU1 – door systems/frames
BU2 – windows
BU3 – door lock systems
BU4 – window winder

Fundamental units

Functional Units (FU)

FU1 – finance/controlling
FU2 – personnel/IT
FU3 – sales/marketing
FU4 – production
FU5 – engineering/R&D
FU6 – supply

FIG.18: Example for the structuring of a production line

Production line A
(paint shop/system)

Automotive application   Industrial application

Operational
units

Painting
components
(e.g. bumpers)

Paint shop
Systems
(e.g. cars)

Operational
subunits

Process units
(PU)

Process units
(PU)

...

PU1 – application system
PU2 – conveyor system
PU3 – measuring system